UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/479,810	06/07/1995	JOHANNES G. BEDNORZ	YOR919870074US5	8594

877 7590 09/17/2009

IBM CORPORATION, T.J. WATSON RESEARCH CENTER
P.O. BOX 218
YORKTOWN HEIGHTS, NY 10598

EXAMINER
KOPEC, MARK T

ART UNIT	PAPER NUMBER
1796	

NOTIFICATION DATE	DELIVERY MODE
09/17/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

iplawyor@us.ibm.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JOHANNES G. BEDNORZ and CARL A. MUELLER

Appeal 2009-003320
Application 08/479,810
Technology Center 1700

Decided: September 15, 2009

Before BRADLEY R. GARRIS, BEVERLY A. FRANKLIN, and LINDA M. GAUDETTE, *Administrative Patent Judges*.

GARRIS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's decision rejecting claims 1-64, 66-72, 84, 85, 88-96, 100-102, 109-112, 115-122, 126-134, 139, 141-143, 146-149, 153-155, 162-166, 182-184, 187, 188, 192-195, 198-212, 217-219, 222, 223, 227-230, 232-234, 237-240, 244-246, 253-257, 268, 273-275, 278, 279, 283-286, 289-295, 302, 303, 308-310,

313, 314, 318-329, 331-334, 337-345, 347-357, 359-374, 376, 382, 383, 389, 394, 395, 402, 407, 408, 414-419, 421-424, 426-501, 508-510 and 516-543.[1] We have jurisdiction under 35 U.S.C. § 6.

We AFFIRM-IN-PART.

Statement of the Case

Based on a discovery for which they won a Nobel prize, Appellants claim a combination, apparatus, device, or structure comprising a material exhibiting a superconductive state at a temperature greater than or equal to 26°K. This material is broadly and variously defined in the rejected claims

[1] For purposes of clarification, we make the following points. (1) The claims listed above are the claims we consider to be under rejection and on appeal since they are the claims listed by the Examiner in the sole statement of rejection presented in the Answer (Ans. para. bridging 5-6). (2) In this Opinion, as in the Answer (Ans. 2), references to the multiple dependent claims under rejection are limited to those claims which depend from rejected parent claims. (3) The record of this appeal includes the Appeal Brief filed 15 May 2008 as volumes 1-5 and the attachments thereto, the Examiner's Answer mailed 20 August 2008, the Reply Brief filed 20 October 2008, the Reply Brief Supplement 1 filed 21 October 2008, the Reply Brief Supplement 2 filed 28 October 2008, the Reply Brief Supplement 3 filed 6 November 2008, and the Transcript of the Oral Hearing held 10 June 2009. (4) As presented in the Claims Appendix (App. Br., vol. 1), certain claims *(see* claims 466, 467, 476, 477, 517, 518, 522) contain typographical errors in the recitation directed to superconducting transition temperature T_c. For purposes of this appeal and consistent with Appellants' arguments (e.g., *see* App. Br., vol. 3, pts. 7-8), we interpret these claims to require a T_c of greater than or equal to 26°K. (5) Appellants appear to have withdrawn their request that the Board resolve an issue concerning claim of priority (*compare* Hearing Transcript 3 *with* App. Br., vol. 1, p. 55-65). Regardless, such an issue must be resolved by way of petition not appeal. *See* Manual of Patenting Examining Procedure (MPEP) § 1201 (Rev. 3, August 2005) and MPEP §§ 1002-1003 (Rev. 2, May 2004).

as being, for example, an oxide, a composition, a ceramic characteristic, and a means.

Rejected claims defining the above-described subject matter include claims 12, 88, 115, 117, 374, and 438 which read as follows:

12. A superconducting combination, comprising a superconductive oxide having a transition temperature greater than or equal to 26°K,

means for passing a superconducting electrical current through said composition [sic] while said composition is at a temperature greater than or equal to 26°K and less than said transition temperature, and

cooling means for cooling said composition to a superconducting state at a temperature greater than or equal to 26°K.

88. An apparatus comprising:

a composition exhibiting a superconductive state at a temperature greater than or equal to 26°K,

a cooler for cooling said composition to a temperature greater than or equal to 26°K at which temperature said composition exhibits said superconductive state, and

a current source for passing an electrical current through said composition while said composition is in said superconductive state.

115. A device comprising a transition metal oxide having a T_c greater than or equal to 26°K carrying a superconducting current said transition metal oxide is maintained at a temperature less than said T_c.

117. A structure comprising a transition metal oxide having a T_c greater than or equal to 26°K carrying a superconducting current.

374. A combination, comprised of:

a material comprising a ceramic characteristic comprising an onset of superconductivity at an onset temperature greater than or equal to 26°K,

means for passing a superconducting electrical current through said material comprising a ceramic characteristic while said material is maintained at a temperature greater than or equal to 26°K and less than said onset temperature, and

means for cooling said superconducting material having a ceramic characteristic to a superconductive state at a temperature greater than or equal to 26°K and less than said onset temperature, said material being superconductive at temperatures below said onset temperature and a ceramic at temperatures above said onset temperature.

438. An apparatus comprising: a means for conducting a superconducting current at a temperature greater than or equal to 26°K and a means for providing an electric current to flow in said means for conducting a superconducting current.

Many of the rejected claims define Appellants' superconductive material more narrowly as comprising (1) a transition metal oxide in combination with (2) a rare earth element or a rare earth-like element or a group III B element, and/or (3) an alkaline earth element or a group II A element. This more narrowly defined subject matter is exemplified by claims 163 and 268, which read as follows:

163. An apparatus comprising:

a composition comprising copper, oxygen and any element selected from the group consisting of a Group II A element, a rare earth element and a Group III B element, where said composition is a mixed copper oxide having a non-stoichiometric amount of oxygen therein and exhibiting a superconducting state at a temperature greater than or equal to 26°K;

a temperature controller maintaining said composition in said superconducting state at a temperature greater than or equal to 26°K; and

a current source passing an electrical current through said composition while said composition is in said superconducting state.

268. An apparatus comprising:
a copper oxide comprising a phase therein which exhibits a superconducting state at a critical temperature greater than or equal to 26°K;

a temperature controller for maintaining the temperature of said material [sic] at a temperature less than said critical temperature to produce said superconducting state in said phase;

a source for an electrical supercurrent through said copper oxide while it is in said superconducting state;

said copper oxide includes at least one element selected from group consisting of a Group II A element, at least one element selected from the group consisting of a rare earth element and at least one element selected from the group consisting of a Group III B element.

The sole rejection in this appeal is based on the enablement requirement set forth in the first paragraph of 35 U.S.C. § 112. The statement of this rejection is expressed by the Examiner as follows:

> Claims 1-64, 66-72, 84, 85, 88-96, 100-102, 109-112, 115-122, 126-134, 139, 141-143, 146-149, 153-155, 162-166, 182-184, 187, 188, 192-195, 198-212, 217-219, 222, 223, 227-230, 232-234, 237-240, 244-246, 253-257, 268, 273-275, 278, 279, 283-286, 289- 295, 302, 303, 308-310, 313, 314, 318-329, 331-334, 337-345, 347-357, 359-374, 376, 382, 383, 389, 394, 395, 402, 407, 408, 414-419, 421-424, 426-501, 508-510, and 516-543 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for compositions comprising a transition metal oxide containing at least a) an alkaline earth element or Group IIA element and b) a rare-earth element or Group IIIB element, does not reasonably provide enablement for the invention as claimed. The specification does not enable any person skilled in the art to which it pertains, or

> with which it is most nearly connected, to make the invention commensurate in scope with these claims.

(Ans. 5-6).

As support for this rejection, the Examiner relies upon an article entitled "A Snapshot View of High-Temperature Superconductivity 2002" by Schuller et al.[2] (hereafter Schuller) and an article entitled "Exploring Superconductivity"[3] (Ans. 4 and 21-23). The Examiner also relies on Appellants' Specification as support for this rejection (*see*, for example, Ans. 9).

Appellants' basic position is that the Examiner has failed to make a prima facie case that the rejected claims are not enabled and in any event that Appellants have provided extensive evidence showing persons of ordinary skill in this art can determine species within the scope of the rejected claims without undue experimentation (*see*, for example, App. Br., vol. 3, p. 13-14 et seq.). We refer to the Appeal Brief attachments for a complete listing of this extensive evidence (*see* App. Br., vols. 4-5).

Issue

Have Appellants shown error in the Examiner's conclusion that the rejected claims fail to comply with the enablement requirement in the first paragraph of 35 U.S.C. § 112?

---

[2] Schuller et al., *A Snapshot View of High-Temperature Superconductivity 2002, in* April 5-8 Workshop on High Temperature Superconductivity 1-50 (2002).

[3] *Exploring Superconductivity*, Introduction, http://www.nobelchannel.com/learningstudio/introduction. We note that the web address for this article may no longer be valid. However, this possibility is not a concern in this appeal since Appellants do not challenge the availability of the article.

Summary of Decision

The record of this appeal establishes that Appellants' Specification provides enabling support for the rejected claims which define the material exhibiting a superconductive state at a temperature greater than or equal to 26°K as comprising: (1) a transition metal oxide in combination with (2) a rare earth element or a rare earth-like element or a group III B element, and/or (3) an alkaline earth element or a group II A element.[4]

Findings of Fact

The Specification:

The Specification, originally filed 22 May 1987, describes Appellants' invention as relating to a new class of superconducting compositions having high superconducting transition temperatures and more particularly to superconducting compositions including copper and/or other transition metals wherein the compositions are characterized by a superconducting phase and a layer-like structure (Spec. 1).

As Background Art (Spec. 1), the Specification discloses that prior art superconductors include transition metal compounds and compositions such as Nb_3Ge which exhibits a T_c of about 23°K at ambient pressure (Spec. 3). Prior art superconductors also include oxides such as the Li-Ti-O system with superconducting onsets as high as 13.7°K (Spec. para. bridging 3-4). (We take official notice that Li is an alkali element and that Ti is a transition

[4] Claims 138 and 326/138 are not included in the Examiner's rejection and therefore are not on appeal and are not under our jurisdiction. Nevertheless, we observe that these claims are not limited to the subject matter described as enabled in the Answer (or in this Opinion). Under these circumstances, the Examiner's failure to include claims 138 and 326/138 in the § 112, first paragraph, rejection before us appears to be an inadvertent oversight.

metal.) According to the Specification, "[t]hese materials have multiple crystallographic phases including a spinel structure exhibiting the high T_c[, and] [o]ther metallic oxides, such as the perovskite Ba-Pb-Bi-O system[,] can exhibit superconductivity due to high electron-phonon coupling in a mixed valent compound" (*id.*).

In the Summary of the Invention section, the Specification characterizes Appellants' invention as relating to compositions which can carry supercurrents (i.e., electrical currents in a substantially zero-resistance state of the composition) at temperatures greater than 26°K (Spec. para. bridging 6-7). "In general, the compositions are characterized as mixed transition metal oxide systems where the transition metal oxide can exhibit multivalent behavior" (*id.*). These compositions are disclosed as having a layer-type crystalline structure, often perovskite-like, and can contain a rare earth or rare earth-like element such as a group III B element (e.g., La) (*id.*). Substitutions can be found in the rare earth (or rare earth-like) site and in the transition metal sites of the compositions (*id.*). "For example, the rare earth site can also include alkaline earth elements selected from group IIA of the periodic table, or a combination of rare earth or rare earth-like elements and alkaline earth elements" (*id.*). (We take official notice that there are 18 rare earth and rare earth-like elements and that there are six alkaline earth elements.) The Specification further discloses that "[a]n example of a superconductive composition having high T_c is the composition represented by the formula RE-TM-O, where RE is a rare earth or rare earth-like element, TM is a non-magnetic transition metal, and O is oxygen" (Spec. 8). "If an alkaline earth element (AE) were also present, the composition would be represented by the general formula RE-AE-TM-O" (*id.*). The

Specification teaches that "[t]he methods by which these superconductive compositions can be made can use known principles of ceramic fabrication" (Spec. para. bridging 8-9).

In the Description of the Preferred Embodiments section, the Specification again discloses that "[t]he superconductive compositions of this invention are transition metal oxides generally having a mixed valence and a layer-like crystalline structure" (Spec. 11). "These compositions can also include a rare earth site in the layer-like structure where this site can be occupied by rare earth and rare earth-like atoms, and also by alkaline earth substitutions" (*id.*). The Specification additionally discloses:

> An example of a superconductive compound having a layer-type structure in accordance with the present invention is an oxide of the general composition RE_2TMO_4 where RE stands for the rare earths (lanthanides) or rare earth-like elements and TM stands for a transition metal. In these compounds the RE portion can be partially substituted by one or more members of the alkaline earth group of elements. In these particular compounds, the oxygen content is at a deficit.

(Spec. para. bridging 11-12).

> For example, one such compound that meets this general description is lanthanum copper oxide La_2CuO_4 in which the lanthanum - which belongs to the IIIB group of elements - is in part substituted by one member of the neighboring IIA group of elements, viz. by one of the alkaline earth metals (or by a combination of the members of the IIA group), e.g., by barium.

(Spec. 12). The Specification also teaches that "[b]oth La_2CuO_4 and $LaCuO_3$ are metallic conductors at high temperatures in the absence of barium" and that "the Ba-La-Cu-O type materials are essentially ceramics,

as are the other compounds of the Re_2TMO_4, type, and their manufacture generally follows the known principles of ceramic fabrication" (Spec. para. bridging 15-16). Finally, in the concluding paragraph, the Specification discloses: "Thus, the invention broadly relates to mixed (doped) transition metal oxides having a layer-like structure that exhibit superconducting behavior at temperatures in excess of 26°K" (Spec. para. bridging 27-28).

The Examiner's Evidence:

The Examiner finds that the high temperature superconductor art is unpredictable and concludes that Appellants' Specification does not provide reasonable detail which would enable persons with ordinary skill in this unpredictable art to practice the full scope of the rejected claims without undue experimentation (Ans. 5-6).

As support for the finding of unpredictability in the high temperature superconductor art, the Examiner relies on the Schuller article "A Snapshot View of High-Temperature Superconductivity 2002", which discloses:

> Thus far, the existence of a totally new superconductor has proven impossible to predict from first principles. Therefore, their discovery has been based on largely on empirical approaches, intuition, and even serendipity. This unpredictability is at the root of the excitement that the condensed matter community displays at the discovery of a new material that is superconducting at high temperature.

(Schuller 7).

As further support for this unpredictability, the Examiner relies on the article entitled "Exploring Superconductivity". With respect to the high temperature superconductor compounds discovered by Appellants, this article discloses:

> It is worth noting that there is no accepted theory to explain the high-temperature behavior of this type of compound. The BCS theory, which has proven to be a useful tool in understanding lower-temperature materials, does not adequately explain how the Cooper pairs in the new compounds hold together at such high temperatures.

("Exploring Superconductivity" 3).

Unpredictability in this art also is supported by the Examiner's uncontested findings that the Specification discloses numerous compounds or compositions which fall within the compositional definitions of the rejected claims yet fail to exhibit superconductivity at temperatures greater than or equal to 26°K (Ans., first full para. at 9, para. bridging 11-12).

Appellants' Evidence:

In support of their enablement position, Appellants have provided this record with extensive factual evidence. This evidence includes affidavits under 37 C.F.R. § 1.132 by Timothy Dinger (executed 4 April 2005), by Thomas M. Shaw (executed 14 April 2005), and by Chang C. Tsuei (executed 5 April 2005) which are collectively referred to by Appellants as the DST Affidavits. The Shaw Affidavit (*see* App. Br., vol. 5, Evidence Appendix, Attachment AM) is representative and evidences the findings of fact set forth below.

Persons of ordinary skill in this art, using principles of ceramic fabrication known at the time the application was initially filed, can make compositions encompassed by Appellants' claims without undue experimentation or without requiring ingenuity beyond that expected of a person of skill in the art of ceramic materials fabrication (Shaw Affidavit, para. 8).

The composition La_2CuO_4 disclosed in Appellants' Specification (Shaw Affidavit, paras. 16-21) falls within the formula Re_2TMO_4 disclosed in Appellants' Specification (*id.*), and exhibits superconductivity within Appellants' claimed range (i.e., at 39°K) (*id.*; *see also* App. Br., vol. 5, Attachment AB, Rao article of record).

The high temperature copper oxide superconductors disclosed by Appellants are not difficult to synthesize, and Appellants' disclosed characteristics of the superconductors (e.g., layered, perovskite-like, mixed-valence) have been confirmed by subsequent work (Shaw Affidavit, paras. 46-49; *see also* App. Br., vols. 4-5, Attachments AF, Z, and AG, the Poole 1988, Poole 1995, and Poole 1996 Pubs. of record).

Shaw states:

> I have personally made many samples of high Tc [sic,T_c] superconductors following the teaching[s] of Bednorz and Mueller as found in their patent applications. In making these materials it was not necessary to use starting materials in stoichiometric proportions to produce a high T_c superconductor with insignificant secondary phases or multi-phase compositions, having a superconducting portion and a non-superconducting portion, where the composite was a high Tc [sic, T_c] superconductor. Consequently, following the teaching[s] of Bednorz and Mueller and principles of ceramic science known prior to their discovery, I made, and persons of skill in the ceramic arts were able to make, high T_c superconductors without exerting extreme care in preparing the composition. Thus I made and persons of skill in the ceramic arts were able to make high T_c superconductors following the teaching[s] of Bednorz and Mueller, without experimentation beyond what was well known to a person of ordinary skill in the ceramic arts prior to the discovery by Bednorz and Mueller.

(Shaw Affidavit, para. 50). Corresponding statements are made at paragraph 50 of the Dinger and Tsuei affidavits.

Principles of Law

"Although not explicitly stated in section 112, to be enabling, the specification of a patent [application] must teach those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation.'" *In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993). "Nothing more than objective enablement is required, and therefore it is irrelevant whether this teaching is provided through broad terminology or illustrative examples." *Id.*

> When rejecting a claim under the enablement requirement of section 112, the PTO bears an initial burden of setting forth a reasonable explanation as to why it believes that the scope of protection provided by that claim is not adequately enabled by the description of the invention provided in the specification of the application; this includes, of course, providing sufficient reasons for doubting any assertions in the specification as to the scope of the enablement. If the PTO meets this burden, the burden then shifts to the applicant to provide suitable proofs indicating that the specification is indeed enabling.

Id. at 1561-62. In order to carry this burden, the applicant must establish by evidence or arguments that, on the application filing date, a person of ordinary skill in the art would have believed reasonably that applicants' success with a particular species could be extrapolated with a reasonable expectation of success to other species. *Id.* at 1564 ("Wright has failed to establish by evidence or arguments that, in February of 1983, a skilled scientist would have believed reasonably that Wright's success with a

particular strain of an avian RNA virus could be extrapolated with a reasonable expectation of success to other avian RNA viruses").

> [A]rguments, focused almost exclusively on the level of skill in the art, ignore the essence of the enablement requirement. Patent protection is granted in return for an enabling disclosure of an invention, not for vague intimations of general ideas that may or may not be workable. *See Brenner v. Manson*, 383 U.S. 519, [535-]36, 86 S. Ct. 1033, 1042-43, 16 L.Ed 2d 69, 148 USPQ 689, 696 (1966) (stating, in context of the utility requirement, that "a patent is not a hunting license. It is not a reward for the search, but compensation for its successful conclusion."). Tossing out the mere germ of an idea does not constitute enabling disclosure. While every aspect of a generic claim certainly need not have been carried out by an inventor, or exemplified in the Specification, reasonable detail must be provided in order to enable members of the public to understand and carry out the invention.

Genentech, Inc. v. Novo Nordisk A/S, 108 F.3d 1361, 1366 (Fed. Cir. 1997).

> It is true . . . that a specification need not disclose what is well known in the art. . . . However, that general, oft-repeated statement is merely a rule of supplementation, not a substitute for a basic enabling disclosure. It means that the omission of minor details does not cause a specification to fail to meet the enablement requirement. However, when there is no disclosure of any specific starting material or any of the conditions under which a process can be carried out, undue experimentation is required; there is a failure to meet the enablement requirement that cannot be rectified by asserting that all the disclosure related to the process is within the skill of the art. It is the specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement.

Id. "Where, as here, the claimed invention is the application of an

unpredictable technology in the early stages of development, an enabling description in the specification must provide those skilled in the art with a specific and useful teaching." *Id.* at 1367-68.

"Enablement is not precluded by the necessity for some experimentation such as routine screening. However, experimentation needed to practice the invention must not be undue experimentation. 'The key word is 'undue' not 'experimentation'". *In re Wands*, 858 F.2d 731, 736-37 (Fed. Cir. 1988), quoting *In re Angstadt*, 537 F.2d 498, 504 (CCPA 1976).

> The determination of what constitutes undue experimentation in a given case requires the application of a standard of reasonableness, having due regard for the nature of the invention and the state of the art. The test is not merely quantitative, since a considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed.

Id. at 737 (Citations omitted).

> Factors to be considered in determining whether a disclosure would require undue experimentation . . . include (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

Id. (Citations omitted).

Analysis

Subsection I: Claims which define the high temperature superconductive material as comprising (1) a transition metal oxide in combination with (2) a rare earth element or a rare earth-like element or a group III B element, and (3) an alkaline earth element or a group II A element.

With respect to all appealed claims, Appellants argue that the Examiner has failed to establish a prima facie case for lack of enablement (*see* App. Br., vol. 3, pts. 1-8, for example para. bridging 143-144 regarding claim 72).

Appellants' argument is persuasive with regard to the claims under consideration identified in the subsection I heading above. This is because these claims define the subject matter which the Examiner has identified as enabled by Appellants' Specification (Ans. para. bridging 5-6; *see also* first full para. at 7). Therefore, the Examiner not only has failed to establish or even assert non-enablement for these claims but has expressly stated that the subject matter of the claims is enabled. On the record before us, the Examiner's rejection of such claims appears to have been an inadvertent oversight.

Our study of the appealed claims as presented by Appellants in the Appeal Brief (i.e., the claims as reproduced in the Claims Appendix of App. Br., vol. 1, and as in reproduced in App. Br., vol. 3, pts. 1-8) reflects that the following rejected claims define subject matter which the Examiner considers to be enabled: claims 72, 134, 268, 290-292, 376, 421, 497, and 499. These claims also define subject matter which this panel of the Board considers to be enabled as explained more fully below.

For these reasons, we will not sustain the Examiner's §112, first paragraph, rejection of these claims.

Subsection II: Claims which define the high temperature superconductor material as comprising (1) a transition metal oxide in combination with either (2) a rare earth element or a rare earth-like element or a group III B element, or (3) an alkaline earth element or a group II A element.

With respect to all appealed claims, including those defining subject matter identified in the subsection II heading above, Appellants argue that the Examiner has failed to establish a prima facie case for lack of enablement and that, in any event, they have provided extensive evidence showing these claims are enabled (*see* App. Br., vol. 3, pts. 1-8, for example para. bridging 67-68 and para. bridging 69-70 regarding claims 28 and 29).

The Examiner has not explained why this evidence fails to show enablement for the specific claims under review (Ans. 8-27). Instead, the Examiner characterizes Appellants' evidence as failing to establish that the Specification enables the full scope of the rejected claims generally (*id.*). The Examiner explicitly criticizes Appellants' affidavit evidence as "conclusory only" (Ans. 15) although no specific reasons are given for considering the affidavits to be "conclusory only" with respect to the claims discussed in this subsection.

Our review of the arguments and evidence presented by the Examiner and Appellants leads us to conclude that the claim subject matter under consideration is enabled by Appellants' Specification. Our reasons follow.

As noted in our Findings of Fact above, Appellants' Specification expressly discloses that their superconductor compositions are mixed

transition metal oxides (Spec. para. bridging 6-7, first para. at 11, para. bridging 27-28). Moreover, the Specification expressly discloses that these mixed transition metal oxides can contain a rare earth or rare earth-like element (i.e., a group III B element) (*id.* at para. bridging 6-7, first para. at 8, first para. at 11, para. bridging 11-12, para. bridging 15-16, para. bridging 26-27). Significantly, the combination of a transition metal oxide and a group III B element in the form of La_2CuO_4 is explicitly disclosed (Spec. para. bridging 15-16), and this compound possesses a superconductivity T_c of 39°K (i.e., within Appellants' claimed range) as previously noted in the Findings of Fact.

We recognize that the 39°K superconductivity of La_2CuO_4 is not disclosed in the Specification. However, it is undisputed in this record that the fabrication and superconductivity testing of this compound would have been within the skill of an artisan. In addition, the artisan would have reasonably expected the compound to possess high temperature superconductivity since it is a member of a class of compounds which is expressly disclosed in the Specification as possessing this superconductivity characteristic. For these reasons, we conclude that Appellants' Specification teaches an artisan how to make and use La_2CuO_4 as a high temperature superconductor without undue experimentation. That is, La_2CuO_4 is enabled by the Specification as a high temperature superconductor of the type required by the claims under review.

As also noted in the Findings of Fact, the Specification expressly discloses modifications of the above-discussed combination of transition metal oxides and rare earth or rare earth-like elements wherein elements at the rare earth site are substituted with alkaline earth elements selected from

group II A (Spec. para. bridging 6-7). When these substitutions are partial, the results are high temperature superconductor compositions comprising transition metal oxides in combination with rare earth (or rare earth-like) elements and alkaline earth (or group II A) elements which the Examiner has concluded are enabled. However, the Specification also discloses with reasonable detail high temperature superconductor compositions wherein the rare earth (or rare earth-like) elements are completely substituted with alkaline earth elements.

Specifically, the Specification teaches that "[t]he rare earth site can also include alkaline earth elements selected from group IIA of the periodic table, or a combination of rare earth or rare earth-like elements and alkaline earth elements" (*id.*). The first clause of this sentence does not expressly state that the rare earth site can include only alkaline earth elements (i.e., wherein the rare earth or rare earth-like elements are completely substituted with alkaline earth elements). Nevertheless, an artisan would reasonably interpret the first clause in this manner since the alternative second clause explicitly teaches that the rare earth site can include "a combination of rare earth or rare earth-like elements and alkaline earth elements" (*id.*). That is, it would be unreasonable to interpret both of these alternative clauses as disclosing only partial substitution embodiments (i.e., wherein the rare earth site includes a combination of rare earth or rare earth-like elements and alkaline earth elements).

These circumstances support a determination that Appellants' Specification discloses with reasonable detail high temperature superconductors of the type defined by the claims under review as mixed transition metal oxides comprising (1) transition metal oxides in

combination with either (2) rare earth or rare earth-like or group III B elements, or (3) alkaline earth or group II A elements. The question to now be considered is whether enablement of such superconductors is precluded because the Specification disclosure would require undue experimentation in order to practice the claimed invention directed to these superconductors. Factors to be considered in assessing this question include (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. *Wands*, 858 F.2d at 737.

Our consideration of these factors leads to a conclusion that the claims under review are enabled for the following reasons.

Factor (1) the quantity of experimentation necessary:

The quantity of experimentation is limited to transition metal oxides in combination with only 18 rare earth and rare earth-like elements or in combination with only six alkaline earth elements. Further, the record before us establishes that the experimentation needed to make and test the compositions under consideration is merely routine, and the Examiner does not contend otherwise. For these reasons, Factor (1) supports an enablement conclusion.

Factor (2) the amount of direction or guidance presented:

As explained above, Appellants' Specification provides a reasonable amount of direction or guidance in identifying the compositions in question as possessing high temperature superconductive characteristics. Accordingly, this Factor also supports enablement.

Factor (3) the presence or absence of working examples:

While the working examples of Appellants' Specification are limited to mixed transition metal oxides having both rare earth or rare earth-like elements and alkaline earth elements, these working examples in combination with Appellants' previously noted guidance militate for the presumption of enablement and against the Examiner's conclusion of non-enablement.

Factors (4)-(6) the nature of the invention, the state of the prior art, and the relative skill of those in the art:

On this record, there is no dispute that Appellants' claimed invention relates to materials exhibiting superconductivity at high temperatures never before achieved, that the prior art provided no teaching or suggestion of such high temperature superconductors, and that the skill in this art is extremely high. Likewise, there is no dispute on this record that publication of Appellants' discovery (i.e., that certain mixed transition metal oxides exhibit superconductivity at temperatures equal to or greater than 26°K) led within a short period of time to the discovery by others in this art of numerous other high temperature superconductor materials falling within the scope of the claims under review. These circumstances on balance favor a conclusion of enablement for the claims under review.

Factors (7)-(8) the predictability or unpredictability of the art and the breadth of the claims:

For reasons detailed below, the art of high temperature superconductivity is generally unpredictable in that there is generally no

reasonable expectation of successfully achieving high temperature superconductivity. Nevertheless, this general unpredictability is tempered by the claims under consideration which limit the high temperature superconductor materials to classes of compositions expressly identified with reasonable detail in Appellants' Specification. This circumstance in combination with the other factors under consideration, including the limited and routine experimentation necessary to make and test such materials, support a conclusion that the Specification provides a reasonable expectation that materials of the type defined by the claims of this subsection would exhibit the claimed characteristic of high temperature superconductivity.

In light of the foregoing, we conclude that the Specification disclosure would not require undue experimentation for and thereby enables the practice of Appellants' high temperature superconductor invention as limited to mixed transition metal oxides comprising (1) transition metal oxides in combination with either (2) rare earth or rare earth-like or group III B elements, or (3) alkaline earth or group II A elements. Based on the claim reproductions in Appellants' Appeal Brief, we identify the following claims as defining such mixed transition metal oxides: claims 28-30, 33, 35[5], 37,

[5] Dependent claim 35 further defines "the composition" of parent independent claim 34. The claim 34 phrase "the composition" lacks strict antecedent basis due to an apparent oversight by Appellants. Consistent with the record before us (e.g., *see* independent claim 33), a person with ordinary skill in this art would regard claim 34 as providing strict antecedent basis for the phrase "the composition" by interpreting the claim 34 preamble "A superconducting apparatus having a superconducting onset temperature" as though it reads "A superconducting apparatus comprising a composition having a superconducting onset temperature". This is the interpretation we have given to parent claim 34 in assessing the enablement of dependent claim 35.

51, 52, 68, 71, 133, 163-166, 192, 193, 199-201, 205-210, 212, 227, 228, 253-257, 283, 284, 303, 318, 319, 323/163+164+254+255, 324/37, 325/33+35+68, 328/51+52+199-201+371, 339/28-30, 348/253+268, 352/71+134, 353/205-210+212, 354/165+166+290-292, 357/192+193+227+228+256+257+283+284+318+319+407, 371, 394, 395, 407, 408, 416/371, 426/394+395, 501, 509, and 510.

Accordingly, we will not sustain the Examiner's § 112, first paragraph, rejection of these claims as being non-enabled.

Subsection III: The remaining claims on appeal wherein the high temperature superconductor material is not limited to the above-discussed mixed transition metal oxides comprising (1) transition metal oxides in combination with (2) rare earth or rare earth-like or group III B elements, and/or (3) alkaline earth or group II A elements.

Initially, we address Appellants' argument that the Examiner's rejection of claims 438, 440, and 536 should be reversed because these claims recite "means for conducting a superconductive current", and therefore, "since the Examiner has allowed claims to specific examples in the specification, the claims in means plus function form can not be rejected as not being enabled" (App. Br., vol. 1, para. bridging 43-44). This argument is based on the proposition that claims 438, 440, and 536, because of their means plus function form, have the same scope as the claims which are considered to be enabled by the Examiner (i.e., claims in which the superconductor materials comprise (1) transition metal oxides in combination with (2) rare earth or rare earth-like or group III B elements, and (3) alkaline earth or group II A elements).

This argument is unconvincing. As Appellants acknowledged during the Oral Hearing of 10 June 2009, the sixth paragraph of 35 U.S.C. § 112 requires that the means plus function language of the claims under review cover not only the corresponding structure or material described in the Specification but also the equivalents thereof whereby these claims are broader than those considered to be enabled by the Examiner (*see* Hearing Transcript 3-5). Therefore, the mere fact that the Examiner considers more narrow claims to be enabled is an inadequate reason to consider broader claims 438, 440, and 536 to be enabled. It follows that this argument reveals no error in the Examiner's rejection of these claims.

Appellants' other arguments concerning the claims in this subsection correspond to the arguments presented for claim 12 which arguments are reproduced below:

> Claim 12 recites:
>
> > CLAIM 12 A superconducting combination, comprising a superconductive oxide having a transition temperature greater than or equal to 26°K,
> >
> > A current siurce [sic] for passing a superconducting electrical current through said composition while said composition is at a temperature greater than or equal to 26°K and less than said transition temperature, and
> >
> > a temperature controller for cooling said composition to a superconducting state at a temperature greater than or equal to 26°K.
>
> The Examiner has not made as to this claim a prima facie case of lack of enablement for the reasons given in all

> volumes of this Brief. The Examiner has given no specific reasons for rejecting this claim as not enabled. The Examiner has given no specific reasons for rejecting this claim as not enabled. [Sic.] The Examiner has not shown why a person of ordinary skill in the art cannot, based on Applicants' teaching, determine without undue experimentation, species that come within the scope of this claim other than those that the Examiner has expressly stated are enabled. Applicants have shown extensive evidence that persons of skill in the art can determine species within the scope of this claim without undue experimentation. Examples of Applicants' evidence are: the Examiner's First, Second, Third and Fourth Enablement Statements, the Poole 1988, 1995 and 1996 Enablement Statements, the Schuller Enablement Statement and Applicants' Affidavits of Mitzi, Dinger, Tsuei, Shaw, Duncombe, Newns and Bednorz in Brief Attachments AH to AR. In particular the Examiner has given no reason for why this claim is not enabled by Applicants' teaching in view of the underlined limitation of the claim which includes specific limitations on the scope of this claim.

(App. Br., vol. 3, para. bridging 35-36).

We are not persuaded by Appellants' argument that the Examiner has failed to establish a prima facie case of non-enablement for the claims under consideration.

The Examiner's non-enablement position is expressed in the Answer as follows:

> The examiner does not deny that the instant application includes "all know [sic] principles of ceramic science", or that once a person of skill in the art knows of a specific type of composition which is superconducting at greater than or equal to 26K, such a person of skill in the art, using the techniques described in the application, which included all principles of ceramic fabrication known at the time the application was initially filed, can make the known

> superconductive compositions. The numerous 1.132 declarations, such as those of Mitzi, Shaw, Dinger and Duncombe, and the Rao article, are directed to production of know [sic] superconductive materials. What is not a "matter of routine experimentation" in this complex, unpredictable art is arriving at superconductive compositions outside the scope of the allowable claims (e.g., subsequently discovered BSCCO or T1-systems as disclosed in Rao (see response filed 3/8/05, pages 141-143). The examiner respectfully maintains that the instant disclosure has not provided sufficient guidance to produce such materials.

(Ans. 23-24).

As support for the proposition that the high temperature superconductor art is unpredictable, the Examiner relies on the Schuller article and the article entitled "Exploring Superconductivity". This unpredictability also is supported by the examples disclosed in Appellants' Specification of compounds or compositions which fall within the compound or composition formulae defined by the appealed claims but which nevertheless fail to exhibit the claimed high temperature superconductivity (e.g., the non-conducting CuO phase at Specification 14 and the non-superconductive $La_{2-x}Ba_xCuO_{4-y}$ when X equals 0.02 at Specification 18).

Appellants contend that the high temperature superconductor art is predictable rather than unpredictable. According to Appellants, "since the Examiner agrees that in view of Applicants' teaching other embodiments can be made without difficulty and since testing such embodiments for the presence of superconductivity is well know [sic] and routine, the art of high Tc superconductivity is predictable or determinable and thus enabled by Applicants' teaching" (App. Br., vol. 1, p. 84). We do not share Appellants'

premise that the capability of an artisan to make and test embodiments other than those allowed by the Examiner establishes predictability in the art of high temperature superconductivity. On this record, Appellants have not shown the asserted correlation between capability and predictability. Moreover, this premise is contrary to the Schuller article which states:

> Thus far, the existence of a totally new superconductor has proven impossible to predict from first principles. Therefore their discovery has been based largely on empirical approaches, intuition, and even serendipity. This unpredictability is at the root of the excitement that the condensed matter community displays at the discovery of a new material that is superconducting at high temperature.

(Schuller 7).

Appellants argue that the Schuller article actually supports their predictability position and cite the Newns affidavit of record (App. Br., vol. 5, Evidence Appendix, Attachment AP) as support for this argument (App. Br., vol. 1, p. 195-208). Specifically, Appellants urge that their predictability position is supported by Schuller's reference to new superconductor discoveries as based largely on empirical approaches, intuition, and serendipity since these bases are typically used by scientists during the discovery process as evidenced by the Newns affidavit (*id.*). However, Appellants have not established their proposition that predictability is indicated by the use of empirical approaches, intuition, and serendipity in the research and discovery methodology of scientists. Contrary to this proposition, we regard predictability in the context of enablement as involving a reasonable expectation of success. *See Wright*, 999 F.2d at 1564 ("Wright has failed to establish by evidence or arguments that . . . a skilled scientist would have believed reasonably that Wright's

success with a particular strain of an avian RNA virus could be extrapolated with a reasonable expectation of success to other avian RNA viruses").

With respect to the Examiner's reliance on the "Exploring Superconductivity" article as evidencing predictability, Appellants attempt to undermine this evidence via the Bednorz affidavit of record (App. Br., vol. 5, Evidence Appendix, Attachment AQ) which addresses the Bednorz quotation in this article (App. Br., vol. 1, p. 209). Significantly, the Bednorz affidavit fails to address the article disclosure which states that "there is no accepted theory to explain the high-temperature [superconductivity] behavior of this type of compound" ("Exploring Superconductivity", last para.). The absence of such a theory supports the Examiner's unpredictability position.

In summary, the Schuller article and the "Exploring Superconductivity" article support the Examiner's position that the high temperature superconductor art is unpredictable. This position also is supported by the above-noted disclosure in Appellants' Specification of compounds or compositions which fall within the compound and composition formulae of the appealed claims but which nevertheless fail to exhibit high temperature superconductivity. On the other hand, Appellants' arguments and evidence in support of their opposing view are deficient for the reasons detailed earlier. Based on the record before us, therefore, we agree with the Examiner that the art of high temperature superconductivity is unpredictable.

This unpredictability supports a prima facie case of non-enablement. The scope of the claims in this subsection also supports prima facie non-enablement. While Appellants' Specification provides reasonable guidance

for the mixed transition metal oxides discussed previously, there is insufficient if any guidance in the Specification for the other materials embraced by the claims under review as correctly indicated by the Examiner (*see* Ans. 23-24). For example, the Specification provides 23 pages of disclosure concerning these mixed transition metal oxides and their constituent elements (i.e., transition metals, rare earth and rare earth-like elements, and alkaline earths) but does not provide any disclosure at all of making high temperature superconductors from any other specifically identified elements. *See Genentech,* 108 F.3d at 1366 ("[W]hen there is no disclosure of any specific starting material or any of the conditions under which a process can be carried out, undue experimentation is required"). Under these circumstances, we are unconvinced by Appellants' argument that the Examiner has failed to establish a prima facie case of non-enablement for the claims discussed in this subsection.

As rebuttal to a prima facie case of non-enablement, Appellants argue that they "have shown extensive evidence that persons of skill in the art can determine species within the scope of [the claims in this subsection] without undue experimentation" (App. Br., vol. 3, p. 35; *see generally* App. Br., vol. 3, pts. 1-8). These arguments and evidence are unpersuasive for two fundamental reasons. First, they do not carry Appellants' burden of showing enablement with respect to "the full scope of the claimed invention" as defined by the claims under consideration. *Wright*, 999 F.2d at 1561. Second, Appellants' arguments and evidence that these claims are enabled inappropriately rely on the knowledge and skill of the artisan, whereas "[i]t is the Specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate

enablement". *Genentech*, 108 F.3d at 1366. The following discussion is a more detailed exposition of the deficiencies of Appellants' arguments and evidence.

Appellants do not establish enablement via the so-called Examiner's First through Fourth Enablement Statements (App. Br., vol. 3, p. 2-6).

The First Statement involves the Examiner's acknowledgement that artisans using known principles of ceramic fabrication would be able to make known superconductive compositions. However, the claims under review are not limited to ceramic compositions (i.e., compositions which can be made using known principles of ceramic fabrication). More importantly, it is Appellants' Specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement. *Genentech*, 108 F.3d at 1366.

The Examiner's Second Enablement Statement involves a now-dropped § 103 rejection based on the Asahi Shibum article of record. According to Appellants, "for the Examiner to have rejected Applicants' claim over the Asahi Shibum article under 35 USC 103, the Examiner necessarily had to find that Applicants' article [i.e., the Asahi Shibum article and therefore Appellants' Specification] fully enabled their claims" (App. Br., vol. 3, p. 4; bolding deleted). Contrary to Appellants' presumption, a reference such as the Asahi Shibum article need not be enabled in order to qualify as prior art for the purpose of determining obviousness under § 103. *Symbol Techs., Inc. v. Opticom, Inc.*, 935 F.2d 1569, 1578 (Fed. Cir. 1991).

The Third Enablement Statement also relates to a now-dropped prior art rejection which Appellants state was based on inherency. Appellants argue that

> the rejection for inherency necessarily requires that a person of skill in the art be able to make the compositions of matter described in the prior art which necessarily means that it was and is the Examiner's position that a person of skill in the art is enabled to make high Tc compositions of matter

(App. Br., vol. 3, p. 5). We perceive no merit in this argument for reasons analogous to those expressed above with respect to the Examiner's First Enablement Statement.

The Fourth Enablement Statement involves a remark said by Appellants to have been made by the Examiner "at page 6 of Office Action dated 07/28/2004:

> Small changes in composition can result in dramatic changes in or loss of superconducting properties."

(App. Br., vol. 3, para. bridging 5-6). Appellants contend:

> By stating that "[s]mall changes in composition can result in dramatic changes in or loss of superconducting properties" the Examiner is, in fact, acknowledging that the compositions can be made and tested to determine whether the composition has the desired superconducting property. This is all that enablement requires.

(*Id.*). We do not agree with Appellants that the Examiner's statement constitutes the above-quoted acknowledgement. Further, we do not agree with Appellants that the mere capability to make and test compositions encompassed by the claims under review satisfies the enablement requirement. Rather, enablement requires the Specification to teach those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation wherein it is the Specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an

invention in order to constitute adequate enablement. *Genentech,* 108 F.3d at 1365-1366.

Appellants also argue that enablement is evidenced by the so-called Poole 1988, 1995, and 1996 enablement statements (App. Br., vol. 3, p. 6-8).

We cannot agree.

The Poole 1988 statement merely indicates that fabrication of copper oxide superconductors is within the skill of this art. As explained earlier, the capability of an artisan to fabricate such materials is by itself inadequate to establish enablement. Moreover, this capability relates to the knowledge and skill of an artisan rather than to the requirement that a Specification supply the novel aspects of a claimed invention in order to provide enablement. *Genentech*, 108 F.3d at 1366.

The Poole 1995 and 1996 enablement statements involve confirmation that high temperature superconductors possess characteristics disclosed in Appellants' Specification such as metallic, perovskite-like, mixed-valence, and layered structure characteristics. While it is true that the Specification associates these characteristics with Appellants' invention of mixed transition metal oxide superconductors, the Specification also associates these same characteristics with prior art superconductors. See the Background Art section of the Specification wherein prior art superconductors are described as metallic (Spec. para. bridging 1-2), perovskite-like (Spec. para. bridging 3-4) which includes a layered structure, and mixed-valence (*id.*). We do not see and Appellants do not explain why enablement is evidenced by the fact that the same characteristics are exhibited by superconductors known in the prior art and the superconductors discovered by Appellants. In any event, we again remind Appellants that it

is the Specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute enablement. *Genentech,* 108 F.3d at 1366.

Appellants also rely on the so-called Schuller enablement statement as evidence of enablement (App. Br., vol. 3, p. 8-9). This statement concerns Schuller's above-discussed disclosure that the process of superconductor discovery includes, for example, the use of intuition. We have previously explained why this disclosure does not establish predictability in the high temperature superconductor art. For analogous reasons, Schuller's disclosure fails to evince enablement for the claims in this subsection.

As support for their enablement position, Appellants additionally rely on the affidavits of record by Mitzi, Dinger, Tsuei, Shaw, Duncombe, Newns, and Bednorz (*See* App. Br., vol. 5, Evidence Appendix, Attachments AH to AR). The Newns and Bednorz affidavits do not support Appellants' enablement position for the same previously-given reasons that they do not support Appellants' predictability position. The remaining affidavits share common deficiencies. The Shaw affidavit (App. Br., vol. 5, Evidence Appendix, Attachment AM) is illustrative. In this affidavit, Shaw states that persons of ordinary skill in this art are capable of fabricating ceramic materials exhibiting high temperature superconductivity by using principles of ceramic fabrication known in the prior art (*see* e.g., paras. 8, 11, 49, 50). Such statements do not evince enablement for reasons explained earlier. That is, all the claims under consideration are not limited to high temperature superconductive ceramic materials. Moreover, it is the Specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement.

Genentech, 108 F.3d at 1366. The affidavits relied upon by Appellants do not explain how the Specification supplies novel aspects of Appellants' invention to thereby enable the full scope of the claims under consideration.

In light of the foregoing, the arguments and evidence presented by Appellants in this appeal have little if any value in establishing that, on the original application filing date of 22 May 1987, a skilled scientist in this art would have believed reasonably that Appellants' high temperature superconductivity success with the mixed transition metal oxide materials discussed above could be extrapolated with a reasonable expectation of success to other materials. *See Wright*, 999 F.2d at 1564 ("Wright has failed to establish by evidence or arguments that, in February of 1983, a skilled scientist would have believed reasonably that Wright's success with a particular strain of avian RNA virus could be extrapolated with a reasonable expectation of success to other avian RNA viruses").

Appellants rely on numerous legal authorities in support of their enablement viewpoint. For the most part, however, these authorities and Appellants' arguments regarding them are not concerned with the pivotal question of why Appellants' Specification would have led an artisan to reasonably believe that Appellants' success with the previously noted mixed transition metal oxides could be extrapolated with a reasonable expectation of success to the other materials embraced by the claims of this subsection. Nevertheless, it is important that we clarify misimpressions created by Appellants' arguments regarding certain legal authorities.

Appellants quote the following statement from *In re Fischer*, 427 F.2d 833, 839 (CCPA 1970):

> It is apparent such an inventor should be allowed to dominate the future patentable inventions of others where those inventions were based in some way on his teachings.

Appellants present the following argument regarding this quoted statement:

> From this statement[, it] is clear that applicants such as the Applicants of the present invention "should be allowed to dominate the future patentable inventions of others where those inventions were based in some way on his teachings". In the present application[,] it is undisputed that the high Tc materials discovered by others after Applicants' discovery "were based in some way on [Applicants'] teachings."

(App. Br., vol. 1, p. 77).

For purposes of record clarification, we point out that our reviewing court has specifically characterized Appellants' quoted statement from *Fischer* as

> dictum [which] only sets the context for *Fischer's* holding that "[i]t is equally apparent, however, that [the inventor] must not be permitted to achieve this dominance by claims which are insufficiently supported and hence not in compliance with the first paragraph of 35 U.S.C. § 112." [*Fischer*, 127 F.2d at 839].

Plant Genetic Sys. v. DeKalb Genetics Corp., 315 F.3d 1335, 1340 (Fed. Cir. 2003). Further, the *Plant Genetic* decision affirms that pioneering inventions (e.g., Appellants' Nobel prize winning discovery of high temperature superconductors) are not entitled to a lower standard of enablement. *Id.* at 1341-42.

In support of their enablement view, Appellants also present their analysis of the factors identified in *Wands*, 858 F.2d at 737 as relevant to determining whether their Specification disclosure enables the claims under

consideration without undue experimentation (App. Br., vol. 1, p. 125-129). In the discussion below, we apply these factors to the legal and factual issues of this appeal in order to obtain benefit of the analysis and in order to clarify certain incorrect aspects of Appellants' analysis.

The *Wands* factors include (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. *Wands*, 858 F.2d at 737.

Factor (1) the quantity of experimentation necessary:

There is no meaningful limit to the quantity of experimentation required by the claims in this subsection. This is because these claims define the recited high temperature superconductor with a broad scope which includes, for example, any oxide (claim 12) or any composition (claim 88). According to Appellants, "Applicants have shown that the quantity of experimentation needed to make samples to use the invention based on the content of the disclosure in the specification is routine experimentation" (App. Br., vol. 1, p. 128). This statement is inaccurate. As previously explained, Appellants' evidentiary showing is essentially limited to the fabrication of mixed transition metal oxides as defined by the claims in subsections I and II above. On this record, Appellants have presented no showing which is commensurate in scope with the claims under review in this subsection III. It follows that Factor (1) supports a conclusion of non-enablement.

Factor (2) the amount of direction or guidance presented:

We have explained earlier that Appellants' Specification gives no direction or guidance for making and using any high temperature superconductor material other than the mixed transition metal oxides discussed in subsections I and II. Appellants state that they "have provided extensive direction to make materials to practice their claimed invention [and that] [t]hey have included all known principles of ceramic science" (App. Br., vol. 1, p. 127). This is not correct in two respects. First, the Specification contains no direction for making high temperature superconductors (e.g., *see* claims 12 and 88) other than the mixed transition metal oxides. Second, the Specification disclosure concerning known principles of ceramic science relates to direction provided by the prior art, not by Appellants. Therefore, Factor (2) also evinces non-enablement.

Factor (3) the presence or absence of working examples:

The Specification contains no working examples at all of high temperature superconductors other than mixed transition oxide materials, and none of the claims under consideration are limited to such materials. According to Appellants, they "have provided sufficient working examples and examples of compositions that have $T_c \geq 26°K$ for a person of skill in the art to fabricate materials that can be used to practice Applicants' claimed invention" (App. Br., vol. 1, p. 127). This statement is inconsistent with the fact that the Specification examples are limited to the mixed transition metal oxides discussed in subsection I. Under these circumstances, a non-enablement conclusion is supported by Factor (3).

Factor (4) the nature of the invention:

The nature of the invention defined by the claims in this subsection is unique for two reasons. First, prior to Appellants' discovery, there were no superconductors known to exhibit superconductivity at a temperature greater than or equal to 26°K. Second, the claims of this subsection encompass a broad scope of materials exhibiting this superconductivity (e.g., all oxides per claim 12 and all compositions per claim 88) which far exceeds the mixed transition metal oxide materials defined by the claims in subsections I and II. With respect to this factor, Appellants state "[t]he invention is easily practiced by a person of skill in the art" (App. Br., vol. 1, p. 126). We do not see the relevance of this statement to the factor under review. Furthermore, for reasons explained above, the arguments and evidence of record do not support the proposition that the full scope of the invention defined by the claims of this subsection "is easily practiced by a person of skill in the art" (*id.*). As a consequence, this Factor supports non-enablement.

Factor (5) the state of the prior art:

Based on the record before us, there is no prior art relating to high temperature superconductors of the type defined by the claims under consideration. According to Appellants, "[t]he state of the prior art clearly shows how to fabricate materials which can be used to practice Applicants' invention" (App. Br., vol. 1, p. 126). Appellants' statement is not correct. The prior art of record in this appeal is limited to fabrication of mixed transition metal oxide materials of the type discussed in subsections I and II. None of the claims in this subsection III are limited to such materials. The absence of prior art indicates non-enablement for the high temperature

superconductors defined by the claims of this subsection which comprise materials other than the above-noted mixed transition metal oxides.

Factor (6) the relative skill of those in the art:

This factor is addressed in the affidavits of record provided by Appellants. The Shaw affidavit (App. Br., vol. 5, Evidence Appendix, Attachment AM) is representative and contains the following statements regarding the relative skill of those in this art:

> Prior to 1986 a person of ordinary skill in the art of fabricating a composition according to the teaching of Bednorz-Mueller application would have: a) a Ph.D degree in solid state chemistry, applied physics, material science, metallurgy, physics or a related discipline and have done thesis research including work in the fabrication of ceramic materials; or b) have a Ph.D degree in these same fields having done experimental thesis research plus one to two years post-Ph.D work in the fabrication of ceramic materials; or c) have a masters degree in these same fields and have had five years of materials experience at least some of which is in the fabrication of ceramic materials. Such a person is referred to herein as a person of ordinary skill in the ceramic fabrication art.

(Shaw Affidavit, para. 11). With regard to testing a material for superconductivity, the Shaw affidavit states:

> Prior to 1986 a person having a bachelor's degree in an engineering discipline, applied science, chemistry, physics or a related discipline could have been trained within one year to reliably test a material for the presence of superconductivity and to flow a superconductive current in a superconductive composition.

(Shaw Affidavit, para. 10). We adopt these affidavit statements as defining a high level of skill in this art. In addition, we consider these affidavit

statements as generally corresponding to Appellants' characterization of this factor (App. Br., vol. 1, para. bridging 126-127). Importantly, this skill is concentrated in the ceramic materials art whereas the claims under consideration are not all so limited. These circumstances lead to a determination that Factor (6) neither militates for nor against enablement of the full scope of protection sought by the claims in this subsection.

Factor (7) the predictability or unpredictability of the art:

For the reasons fully detailed above, we consider the high temperature superconductor art to be unpredictable and disagree with Appellants' contrary view (App. Br., vol. 1, p. 127). This is especially so with respect to the claims under consideration since Appellants' Specification provides no direction or guidance for making the claimed high temperature superconductors other than the mixed transition metal oxides previously discussed. Accordingly, this Factor supports non-enablement.

Factor (8) the breadth of the claims:

We have already explained that the claims in this subsection encompass broadly claimed high temperature superconductors such as oxides (claim 12) and compositions (claim 88) whose scope far exceeds the mixed transition metal oxides of subsections I and II. According to Appellants, "[t]heir claims are as broad as their discovery which is that compounds, such as ceramics, more particularly, oxides, metal oxides, transition metal, etc. can carry a superconductive current for a $T_c \geq 26$ K [sic, 26 °K]" (App. Br., vol. 1, p. 126). However, it is important to clarify that the record of this appeal does not support Appellants' implication that the Specification discloses their discovery with sufficient detail to enable those skilled in this art to make and use the full scope of the invention defined by

the claims under consideration. As discussed above, Appellants' arguments and evidence of record have little if any value establishing that an artisan would have reasonably believed that Appellants' high temperature superconductivity success with mixed transition metal oxides could be extrapolated with a reasonable expectation of success to the other materials encompassed by the claims of this subsection. For these reasons, Factor (8) evinces non-enablement.

Our analysis of these factors leads us to conclude that a reasonable basis exists for believing that the scope of protection provided by the claims under review is not adequately enabled by the Specification description of the invention and that Appellants have failed to carry their burden to provide suitable proofs that their Specification, in fact, teaches those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation. Therefore, we will sustain the Examiner's § 112, first paragraph, rejection for lack of enablement of the claims addressed in this subsection III (i.e., all rejected claims except for the claims identified in subsections I and II).

Conclusions of Law

Appellants have shown error in the Examiner's conclusion that the rejected claims fail to comply with the enablement requirement in the first paragraph of 35 U.S.C. § 112 with respect to claims 72, 134, 268, 290-292, 376, 421, 497, and 499.

Accordingly, we do not sustain the Examiner's § 112, first paragraph, rejection of these claims as being non-enabled.

Appellants have shown error in the Examiner's conclusion that the rejected claims fail to comply with the enablement requirement in the first

paragraph of 35 U.S.C. § 112 with respect to claims 28-30, 33, 35, 37, 51, 52, 68, 71, 133, 163-166, 192, 193, 199-201, 205-210, 212, 227, 228, 253-257, 283, 284, 303, 318, 319, 323/163+164+254+255, 324/37, 325/33+35+68, 328/51+52+199-201+371, 339/28-30, 348/253+268, 352/71+134, 353/205-210+212, 354/165+166+290-292, 357/192+193+227+228+256+257+283+284+318+319+407, 371, 394, 395, 407, 408, 416/371, 426/394+395, 501, 509, and 510.

For this reason, we also do not sustain the § 112, first paragraph, rejection of the above-noted claims as being non-enabled.

Appellants have not shown error in the Examiner's conclusion that the remaining rejected claims fail to comply with the enablement requirement in the first paragraph of 35 U.S.C. § 112.

It follows that we sustain the § 112, first paragraph, rejection of these remaining claims as being non-enabled.

Order

The decision of the Examiner is affirmed-in-part.

Notice Regarding Any Request for Rehearing

Any request for rehearing of this decision under 37 C.F.R. § 41.52 must be limited to points of fact and/or law which Appellants believe were overlooked or misapprehended in rendering this Decision. "Arguments not raised in the briefs before the Board and evidence not previously relied upon in the brief and any reply brief(s) are not permitted in the request for rehearing except as permitted by paragraphs (a)(2) and (a)(3) of this section." 37 C.F.R. § 41.52(a)(1) (2007). In any request for rehearing,

Appellants must state with particularity each point of law or fact they believe was overlooked or misapprehended, must argue in support of each point, and must refer with particularity to where the argument was made originally in the appeal brief or reply brief(s).

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED-IN-PART

ssl

IBM CORPORATION, T.J. WATSON RESEARCH CENTER
P.O. BOX 218
YORKTOWN HEIGHTS, NY 10598